

‘*Candidatus Phytoplasma phoenicium*’

PROGRAM: Almond witches’ broom (AlmWB) survey to be conducted along general detection routes.

TYPE OF PROGRAM: General Visual Observation

PEST DESCRIPTION: Beginning in the 1990s, an epidemic of witches’-broom disease (AlmWB) devastated almond production in Lebanon, spreading rapidly and killing over 150,000 trees in less than two decades. The causal organism was identified as a phytoplasma closely related to, but distinct from members of the pigeon pea witches’ broom phytoplasma group (16SrIX), with a proposed name of ‘*Candidatus Phytoplasma phoenicium*’. This phytoplasma was subsequently found to infect peach and nectarine as well, and recent surveys identified over 40,000 new almond, peach, and nectarine trees infected with AlmWB.



Figure 1. Witches’ broom symptoms in an almond infected with ‘Ca. P. phoenicium’.

SYMPTOMS:

In almond: Symptoms include early flowering, stunted growth, leaf rosetting (a disease symptom characterized by short, bunched growth habit due to shortened internodes and reduction in leaf size), dieback, off-season growth, proliferation of slender shoots, witches’-broom, and smaller pale green leaves (Fig. 1). Witches’-broom symptoms arise mainly from the trunk or roots (Fig. 1). The phytoplasma has also been detected in symptomless almond hosts.

In peach/nectarine: Symptoms early in the growing season include premature flowering followed by the early development of buds. Symptoms later in the growing season include: shoot proliferation, smaller leaves with a pale green color (Fig. 2), abnormal flowers (phyllody), and witches'-broom symptoms in rare cases. Most infected trees do not set any fruit, but some trees bore a limited number of deformed fruits. Symptoms of PPV can be conspicuous (especially on susceptible cultivars) or very subtle on stone fruit trees. Symptoms vary in type and severity with the host, cultivar, environmental factors, and the timing of infection. Diagnostic symptoms occur mainly on leaves and fruits in the United States. In general, leaf symptoms include vein yellowing or light green to yellow rings. Foliar symptoms may develop during the cooler temperatures of spring and fall but fade during the hot summer months. Symptoms of PPV occur sporadically and often are not apparent until three or more years after infection. Newly infected trees are rarely symptomatic. It is critical that symptomless trees be regarded very seriously as they will act as a silent virus source for further infections.



Figure 2. An infected almond branch (left) vs a healthy branch (right).

SURVEY SEASON: Throughout growing season.

SURVEY DENSITY AND FREQUENCY: One property with hosts will be surveyed in every route once per month.

HOSTS: Major hosts: *Prunus dulcis* (almond), *Prunus dulcis* x *Prunus persica* (GF-677 almond/peach hybrid), *Prunus persica* (peach), and *Prunus persica* var. *nucipersica* (nectarine). **Other hosts:** *Anthemis* spp. (chamomile), *Prunus scoparia* (wild almond), and *Smilax aspera* (rough bindweed).

VECTORS: There are three confirmed vectors of 'Ca. P. phoenicium': *Asymmetrasca decedens* (syn. *Empoasca decedens*), *Tachycixius cf cypricus*, and *Tachycixius viperinus*. These vectors are not reported to occur in the United States.

BIOLOGY AND ECOLOGY: Phytoplasmas live exclusively in the phloem tissue of plants and are normally transmitted by vegetative propagation or grafting (seedlings, scions, rootstocks) and by insect vectors. Some phytoplasmas, such as 'Ca. P. solani' (causal agent of bois noir/stolbur disease of grapevine), are transmitted from weeds, which act as reservoir hosts of the pathogen, to economically important hosts. The insect vector can acquire the pathogen from the weedy hosts and transmit to more economically important host plants. The specific biology of 'Ca. P. phoenicium' is currently not well known, but new research has recently led to a better understanding of this pathogen.

COLLECTION AND SUBMISSION OF SAMPLES: Suspect specimens should be collected with 3 to 5 symptomatic leaves, including the petiole, from each suspected diseased plant. Carefully wrap the leaves in paper towels and place in a zip-loc bag with useful information of the site. E-PDRs should be filled out online. Send all samples to Meadowview lab along with a hard copy of the PDR. (should specimens be marked "RUSH") Include indicated suspect in "Remarks" section of the PDR.

REFERENCES:

<http://pest.ceris.purdue.edu/services/approvedmethods/sheet.php?v=1939&from=2020>
<http://pest.ceris.purdue.edu/pest.php?code=FEALMPN>
<https://caps.ceris.purdue.edu/pest-surveillance-guidelines/phytoplasma-sample-screening-confirmation>